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Abstract

Output associated with the research and graduate training of university departments and individual faculty members is examined in the present paper. Convergence among measures of output is evaluated and the necessity for considering academic area when developing performance criteria is investigated. In addition, two new measures of scholarly output--one of publication quality and the other of graduate students' first job quality--are described, and their validity is evaluated in terms of their relationships to other output measures.

CONVERGENCE AMONG ACADEMIC OUTPUTS AS A FUNCTION OF ACADEMIC AREA[1]

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One of the major problems confronting academic institutions is the evaluation of research and teaching output of individual faculty members and academic departments. Much evaluation is currently based arbitrarily on the number of journal article publications and the like. Clearly, academia would be better served if performance criteria were based upon knowledge of the types of output that are appropriate for different academic areas and the relationships among different types of academic outputs.

The convergence among measures of academic output is of obvious importance for developing such criteria. To the extent that measures do converge, one method of evaluation will serve as well as another. However, in the absence of agreement among output measures it will be necessary to develop a multivariate approach to the problem of academic evaluation. Convergence among output measures has most frequently been examined in terms of the relationship between publication quantity and quality. Cole and Cole (1967) studied this problem for physicists. They based their index of publication quality on the number of citations of the scholars' publications. This measure correlated .72 with quantity of publications. Clark (1957) did a similar study for psychologists in which he found a correlation of .45 between number of citations and the total number of the psychologists' publications. The correlation was

.36 when only the publications for a four-year period were considered. Whether these relationships hold for other academic areas and other measures of publication quality is examined in the present paper.

It is also important to ask whether quantity and quality of output are related in the training of graduate students. No relevant studies appear to be available for this question. In the present paper, the relationship is examined between the quantity of dissertations sponsored by the scholar (or, as a departmental index, the total number of dissertations completed in the department) and a measure of the quality of the first jobs which graduate students obtain. A third aspect of convergence is also investigated in this paper: the degree to which measures of research output are related to measures of the output of graduate training.

Most studies of scholarly productivity have been done in the natural sciences (Cole & Cole, 1967; Bayer & Folger, 1966) or psychology (Clark, 1957). It is possible that the degree of convergence among various measures of scholarly output is not the same in all areas. If it is not the same, it would be necessary to combine criteria differently depending upon the area. In addition, the level and significance of each kind of output may differ from one type of field to another. This situation would necessitate differential weighting of outputs in different areas. Both of these possibilities are examined below.

Quality of Research and Graduate Training

The present paper reports a portion of the results of an extensive research project on the organization of university departments. As

part of that project two measures of the quality of output were developed.

1. Quality of Journal Articles. A Quality of Journals Index (QJI) was developed as a measure of the quality of each individual's research output. Because it would have been prohibitively costly to obtain ratings of the quality of each journal article published by each faculty member, the QJI was based upon ratings of the quality of the journals in which his articles appeared. The validity of this procedure rests upon two assumptions. First, it was assumed that each journal has some minimum editorial standards for accepting articles. Second, it was assumed that this minimum standard varies from journal to journal. Given these assumptions, journal article quality is indicated by the quality of journals in which the articles were published.

To our knowledge, the QJI represents a novel approach to measuring publication quality. As indicated above, the most common measure of publication quality has been the citation index which reflects the extent to which the scholar's published works have been cited by others in the field. In their absence, the cost of developing citation indices becomes prohibitive. On the other hand, the QJI has the drawback that it only takes journal article publications into account. Nevertheless, this approach to measuring quality of research output may provide a worthwhile complement to the citation index approach.

2. Quality of First Jobs. One method of assessing the quality of graduate education in a department is to evaluate the Ph.D.s who graduate from it. A "First Job Index"(FJI) was based on ratings of the quality of first jobs obtained by graduating Ph.D.s. Development of the FJI,

described more fully by Fiedler and Biglan (1969), rests on the assumption that highly qualified Ph.D.s will seek jobs in better institutions than will less qualified Ph.D.s. Furthermore, it is assumed that the more distinguished institutions will select and will be able to attract more qualified candidates. Thus, an index based on the rated quality of first jobs obtained by graduating Ph.D.s should reflect the quality of graduate education provided by the department as well as the quality of students the department is able to attract.

Methods

The Setting

This study was conducted at the University of Illinois, Urbana campus, starting in the spring of 1968. The University of Illinois is a large, state-supported, land grant institution which places heavy emphasis on research and graduate training.

The Sample

The sample consisted of faculty members with rank of instructor or above from each of 44 academic departments from the University of Illinois. Because graduate education was a major focus of the project, only Ph.D.-granting departments were included for study.

Measurement of Outputs

Quantity of publications. Each year the University of Illinois releases a pamphlet entitled, Publications of the Faculty. This pamphlet lists for each faculty member all of his publications for the previous

year. For each faculty member in our sample, the numbers of each of the following types of publications over the five-year period from 1964-1968 were tallied: textbooks, monographs, journal articles, and technical reports. In addition to publications, the number of doctoral dissertations sponsored by each faculty member for the years 1964-1968 was obtained from the pamphlet.

To derive departmental level measures of publication output, the total number of each of the above types of publications for the years 1964-1968 was computed for each department. These totals were then divided by the number of faculty members in the department, resulting in per capita measures of departmental publications output.

Quality of Journals Index. To obtain journal quality ratings, lists were first compiled of all journals in which faculty members from each department had published articles in the years 1964 through 1968. Then the executive officer of each department was contacted and asked to recommend five or six individuals from his department who could serve as judges of the quality of journals in their area.

Each faculty judge was sent a list of all journals in which scholars from his department had published articles from 1964-1968, along with a rating form. He was requested to rate the quality of each journal on a five-point scale ranging from "excellent" to "poor." A space was provided for the judge to indicate that he was unacquainted with the journal. After a telephone follow-up, a 91 per cent return rate was obtained on this questionnaire.

A quality score for each journal was computed simply as the average

rating of that journal. To compute the QJI score for a given individual, each journal in which he had published each article over the five-year period was noted and the quality score for that journal was recorded. The individual QJI was then the average of the quality scores associated with his publications. A number of publications appeared in highly obscure journals and for these no ratings were obtained. The number of articles published in these unrated journals turned out to be only ten percent of all the articles published, and these articles were, therefore, dropped from further calculation. A departmental QJI was computed as the average rated quality of all journal articles published from 1964 through 1968 by faculty members in the department.

The reliability of the QJI was assessed by intercorrelating the ratings of each pair of judges within each department. The median interjudge correlation across all departments was .484, indicating that agreement among judges about the quality of journals was relatively low.

In addition to judging the quality of journals, the judges were asked to rate the degree of contribution of each of nine publication media to the expansion of knowledge in their respective fields. The nine media were anthologies, dissertations, monographs, patents, popular press, presentations at professional meetings, professional journals, public performances or exhibitions, and textbooks. The degree of contribution of each medium was rated on a five-point scale ranging from "contributes very much" to "detrimental."

First Job Index. Lists of the first jobs obtained by graduating Ph.D.s for the years 1964-1967 were obtained from each department. Only

jobs obtained by male graduates in the United States were utilized. Lists of jobs were sent to five or six faculty members from each department who had been nominated by the departmental executive officer. Names of the students who had obtained the jobs were not included with the lists. Judges were requested to rate each job as to its desirability as a first position for a graduating Ph.D. from his department. Ratings were made on an eight-point scale ranging from "very desirable" to "very undesirable." The average interjudge reliability of these ratings was .58.

A second reliabilility measure is the split-half reliability of the index, i.e., a split-half correlation of items within a departmental list. Thus, we obtain an average first job index based on the odd items of the list and an average index based on the even items. The correlation over all departments, corrected for length, was .56, and for departments with at least 14 listed positions, this correlation was .72.

The First Job Index (FJI) for a given faculty member was taken as the average rated quality of jobs obtained by students for whom he had served as dissertation sponsor. Faculty members who had sponsored no doctoral students received no FJI score. Departmental FJI scores were computed as the average rated job quality for all graduating Ph.D.s for the years 1964-1967.

An obvious problem with this index is the possibility that faculty members at the University of Illinois might have a tendency to rate the quality of jobs obtained by their own alumni as being higher than would "unbiased" raters. To check for this possibility, the lists of jobs from six of the departments in the sample were rated by six faculty members in

each of the corresponding six departments at the University of Washington. t tests indicated that the average ratings made by University of Washington faculty members did not differ significantly from the ratings made at the University of Illinois. Thus, it appears that a "bias" was not operating in the ratings made at Illinois.

In addition, for each of the six departments, the ratings made at the two institutions were correlated across jobs within each department. The median of the six correlations was .75, indicating that the First Job Index has satisfactory interinstitutional reliability.

American Council on Education Rankings of Faculty Quality. Twenty-four of the departments in our sample were in areas which had been included in Cartter's (1966) study of the quality of departments throughout the United States which was conducted for the American Council on Education. As a result, data were available for each of twenty-four departments on the quality of its graduate faculty as compared with departments in the same field at other universities. The report grouped departments in each field according to whether they were "distinguished," "strong," "good," or "adequate plus." Moreover, a department might not have been highly enough rated to fall into any of these categories. These evaluations of departments were quantified for use in the present study by assigning a score of 5 to "distinguished" departments, 4 to "strong" departments, etc.

Classification of Academic Areas

Biglan (1971) has presented an analysis of the task characteristics of academic areas which is useful for the present study. He performed

multi-dimensional scaling of scholars' ratings of the similarities among 36 different academic task areas. Three orthogonal dimensions were defined by that analysis: 1) a "hard-soft" dimension distinguishing areas high in objectivity such as chemistry, engineering, and botany from less objective areas such as psychology, English, and education; 2) a "pure-applied" dimension distinguishing applied areas such as agriculture, education, and engineering from pure areas such as Lnglish, physics, and psychology; and 3) a life system dimension which distinguished areas such as education, agriculture, and the life sciences from areas such as physics, English and economics. On the basis of this analysis, departments in the present sample can be classified into one of eight cells of a 2 X 2 X 2 design by dichotomizing on each dimension. Table 1 presents such a breakdown.

Insert Table 1 about here

Data Analysis

Relationship of academic area to outputs. To analyze the relationship between academic area and outputs, a 2 X 2 X 2 analysis of variance was performed on each of the individual outputs, based upon the hard-soft, pure-applied, and life system classification. This same analysis was also applied to the ratings of contribution of various scholarly media.

Relationships among outputs. Relationships among individual level outputs were assessed by intercorrelating all output measures. This was first done for the entire sample of scholars. It was also considered

Table 1

Clustering of Academic Areas in Three Dimensions

	HARD		SOFT	
	Non-life System	Life System	Non-life System	Life System
Pure	Astronomy Chemistry Geology Math Physics	Botany Entomology Microbiology Physiology Zoology	English German History Philosophy Russian Communications	Anthropology Political Science Psychology Sociology
Applied	Ceramic Engineering Civil Engineering Computer Science Mechanical Engineering	Agronomy Dairy Science Horticulture Agricultural Economics	Accounting Finance Economics	Educational Administration and supervision Secondary and Continuing Education Special Education Vocational and Technical Education

likely that the relationships among these output measures differ depending on academic area. Therefore, the sample was divided into quadrants on the basis of the position of the scholar's area on the hard-soft and pure-applied dimensions, since these two dimensions were the most important for distinguishing areas. Then correlations among output variables were computed for each sample. In addition, department level output measures were intercorrelated over 44 departments.

Results and Discussion

Relationships between Academic Area and Scholarly Output

Table 2 presents results of analyses of variance for relationships between academic area and scholarly outputs. (Only results significant at $p < .01$ are shown). As indicated above, areas were categorized according to whether they were hard or soft, pure or applied, and concerned with life systems or not. The quantity of monographs and journal articles produced by scholars depends on whether they are in hard or soft areas. In hard areas scholars produce significantly more journal articles and significantly fewer monographs than do their colleagues in soft areas.

Insert Table 2 about here

Scholars in applied areas produce significantly more technical reports than those in pure areas. This is undoubtedly because those in applied areas need to communicate the details of their work to a fairly small and sophisticated group of consumers and the technical report represents an ideal method for such communication. The rated quality of graduate

Table 2

Analysis of Variance for Relationships Between Academic Task Characteristics and Scholarly Output

(Only significant effects ($p < .01$) are reported. Publication data are from the years 1964-1968.)*

Source	DF	F	% Variance
Number of Monographs			
A Hard (.08) - Soft (.28)	1/473	14.54	3
Number of Journal Articles			
A Hard (6.21) - Soft (2.72)	1/473	25.31	5
Quality of Journal Articles			
AC Interaction	1/311	8.22	2
Number of Technical Reports			
B Pure (.16) - Applied (.46)	1/473	6.64	1
Number of Dissertations Sponsored			
(No significant effects)			
Graduate Students' First Job Quality			
B Pure (4.85) - Applied (5.82)	1/75	10.30	11

*Factor A = Hard-Soft

B = Pure-Applied

C = Life system - Non-life system

students' first jobs is also higher in applied than in pure areas. This may be because applied area graduate students obtained better jobs but it could also be because a rating bias exists which causes faculty members in applied areas to rate first jobs of their graduates more highly.

There was a significant interaction between the hard-soft and life system factors as they are related to quality of journals. Hard, non-life system areas such as physics and chemistry had journal articles of higher quality than any of the other areas. Scholars in these areas at Illinois may have produced better research (and these are considered to be outstanding departments) or they may simply have evaluated journal articles per se more highly.

Table 3 presents results of analyses of variance for relationships between academic area and the rated contribution of various scholarly media. Only four results were significant at the .01 level. Compared to scholars in soft areas, those in hard areas rate the contribution of both patents and presentations at professional meetings more highly. Also, scholars in applied areas consider presentations at professional meetings to be a greater contribution to the field than do scholars in pure areas. Finally, a significant interaction between the hard-soft and life system factors on the contribution of the popular press indicated that scholars in soft, non-life system areas such as accountancy and English rate the popular press as a greater contribution to their field than do scholars in other areas.

Insert Table 3 about here

TABLE 3

Analyses of Variance for Relationships between Academic Area and Rated Contribution of Scholarly Media

(Only results significant at $p < .01$ level are shown.)

1. Anthology

Source	DF	F	% Variance
(No significant effects)			

2. Contribution of Dissertations

(No significant effects)

3. Monographs

(No significant effects)

4. Patent

A Hard (2.78) - Soft (2.05)	1/144	23.61	13

5. Popular Press

AC Interaction	1/173	11.86	6

6. Presentation at Professional Meeting

A Hard (4.22) - Soft (3.62)	1/175	19.93	9
B Pure (3.74) - Applied (4.09)	1/175	6.90	3

7. Professional Journal

(No significant effects)

8. Public Performance or Exhibition

(No significant effects)

9. Textbook

(No significant effects)

Taken together, the results for the level of scholarly output and contribution of scholarly media point to the necessity for considering academic area when developing individual and departmental performance criteria. The same standards are not appropriate to all fields. The relative weight given to monographs and journal articles when evaluating a scholar's performance should depend on whether the area is hard or soft. A similar implication follows from the results for the contributions of patents and presentations at professional meetings; these are considered greater contributions in hard areas than they are in soft areas. The technical report has apparently not been examined in previous studies of scholarly output (most of which have studied pure areas). However, the present study indicates that technical reports are a more important output for applied areas than for pure areas, and that it would be a mistake to ignore them in setting up performance criteria in applied areas. Similarly, presentations at professional meetings deserve greater consideration when evaluating scholars in applied areas than when evaluating pure area scholars, since they are considered a greater contribution to the field in the former areas.

Relationships Among Outputs at the Individual Level

Table 4 presents correlations among measures of scholarly output taken across scholars in all academic areas. Due to the large Ns, most of these correlations are significantly different from zero. However, only five correlations are as great as .20. The number of monographs published by scholars is related to their rate of publication of textbooks (.29), journal articles (.21), and technical reports (.25). In turn,

the rate of journal article publication is related to the number of dissertations sponsored (.41) and the number of technical reports (.20). None of the correlations between the journal quality measure and other outputs was greater than .09. For the measure of first job quality, the greatest correlation was only .19 (with number of technical reports).

Insert Table 4 about here

These correlations show that there is slight convergence among the various measures of research output; number of monographs, number of journal articles, quality of journal articles, and number of technical reports. Of particular interest in this respect is the correlation of -.09 between number of journal articles and the journal quality measure. This result is in contrast to the typical finding of moderate to strong relationships between quantity of publications and measures of quality (cf. Cole & Cole, 1967). Similarly, we might expect that the number of dissertations a scholar sponsors is related to the quality of his graduate students' first jobs, if for no other reason than that graduate students seek out the scholars who, they feel, can get them good jobs. However, this correlation is only .08.

Correlations among these same variables were computed separately for each of four sets of academic areas: (1) hard-pure, (2) soft-pure, (3) hard-applied, and (4) soft-applied. These correlations are presented in Table 5. The correlations for the hard-pure areas, such as chemistry or physics, are essentially the same as the correlations over all areas. Especially interesting is the correlation of -.07 between journal quantity

TABLE 4

Correlations Among Individual Output Measures for Scholars in All Academic Areas†

	Number of Textbooks	Number of Monographs	Number of Journal Articles	Rated Quality of Journals	Number of Technical Reports	Number of Dissertations Sponsored
Monographs	.29*					
Journal Articles	.07	.21*				
Journal Quality	-.02	-.02	-.09			
Technical Reports	.01	.25*	.20*	-.05		
Dissertations	.10	.18*	.41*	.07	.10	
First Job Quality	.06	-.02	.03	.09	.19*	.08

†N=559 except for correlations with journal quality, N=319; for the correlations with first job quality, N=83. N=65 for the correlations between first job quality and journal article quality.

*$p < .05$

and quality in hard-pure areas. It is in these areas that previous investigations have shown positive relationships between the quality of scholars' journal articles (as measured by citation rates) and their rate of journal article publication.

Insert Table 5 about here

The second set of correlations is for soft-pure areas such as English and political science. The only distinct difference between this set of correlations and the ones presented above is that the number of technical reports which scholars publish is highly related to their rate of journal article publication.

The third set of correlations presented in Table 5 is for hard-applied areas such as engineering and agriculture. In contrast to the correlations for hard-pure and soft-pure areas, as well as for all areas taken together in hard-applied areas, such as engineering, first job quality is negatively and significantly related to the number of journal articles published (-.57) and the number of dissertations sponsored (-.49). Moreover, in these areas the number of journal articles which scholars publish is significantly related to every other variable except the quality of journal articles. Once again, this is in striking contrast to previous studies which have shown positive correlations between the quantity and quality of scholars' publications.

The final set of correlations in Table 5 is for soft-applied areas such as education and finance. In these areas the various measures of research output are related in about the same manner as in other areas.

TABLE 5

Correlations Among Individual Output Measures within Four Sets of Areas:

(1) Hard-Pure, (2) Soft-Pure, (3) Hard-Applied, (4) Soft-Applied

	Number of Textbooks				Number of Monographs			
	Hard-Pure	Soft-Pure	Hard-Applied	Soft-Applied	Hard-Pure	Soft-Pure	Hard-Applied	Soft-Applied
Monographs	.18*	.53*	.44*	.10				
Journal Articles	.02	.19*	.25*	.32*	.26*	.37*	.31*	.35*
Journal Quality	-.05	-.12	.14	.18	-.12	.02	.08	.14
Technical Reports	-.03	-.01	-.05	.21	.08	.13	.26*	.52*
Dissertations	.10	.08	.20*	.16*	.12	.17*	.28*	.26*
First Job Quality	.19	.14	-.35	.32	-.10	.07	-.18	.38

*$p < .05$

Ns (1) Hard-Pure N=208, except for journal quality N=139, for first job quality N=30, and for journal quality with job quality N=26.

(2) Soft-Pure N=91, except for journal quality N=32, for job quality N=17, and for journal quality with job quality N=10.

(3) Hard-Applied N=150, except for journal quality N=100, for first job quality N=20, and for journal quality with job quality N=18.

(4) Soft-Applied N=110, except for journal quality N=48, for job quality N=16, and for journal quality with job quality N=11.

Table 5 (cont.)

	Number of Journal Articles				Rated Quality of Journals			
	Hard-Pure	Soft-Pure	Hard-Applied	Soft-Applied	Hard-Pure	Soft-Pure	Hard-Applied	Soft-Applied
Monographs	.26*	.37*	.31*	.35*	-.12	.02	.08	.14
Journal Articles					-.07	-.03	-.12	-.22
Journal Quality	-.07	-.03	-.12	-.22				
Technical Reports	.06	.64*	.22*	.14	-.03	.01	-.12	.31
Dissertations	.52*	.37*	.43*	.23*	-.04.	.20	.24*	-.04
First Job Quality	-.05	.32	-.57*	.28	.27	-.28	-.04	.54*

	Number of Technical Reports				Number of Dissertations Sponsored			
Monographs	.08	.13	.26*	.52*	.12	.17*	.28*	.26*
Journal Articles	.06	.64*	.22*	.14*	.52*	.37*	.43*	.23*
Journal Quality	-.03	.01	-.12	.31	-.04	.20	.24*	-.04
Technical Reports					.13	.18*	-.02	.26
Dissertations	.13	.18*	-.02	.26*				
First Job Quality	.12	.31	.12	.58*	.08	.02	-.49	.36

* $p < .05$

However, the measure of first job quality is more strongly related to other variables in soft-applied areas than in other areas. It is positively and significantly related to both the number of technical reports produced by scholars (.58) and the quality of their journal articles (.54).

Regardless of the academic area considered, there appears to be at best only moderate convergence among measures of research productivity. Some of the strongest relationships are between number of dissertations sponsored and other measures of publication quantity. However, this measure is as much an index of effectiveness in graduate training as it is a measure of the sponsor's research productivity. Convergence among publication outputs is smallest in hard-pure areas such as physics and zoology. These results show that it is a mistake to evaluate scholars in terms of a single criterion such as journal article publication. The scholar who produces many publications of one type may not produce publications of another type. One reassuring note in these findings, however, is that in all areas publication rate for journal articles is consistently positively related to the number of dissertations sponsored. This suggests that scholars who are productive researchers are more, rather than less, involved in graduate students' work on their dissertations. Thus, according to these data, research and graduate education do not conflict.

Contrary to existing literature, this study indicates that the quality and quantity of journal article publications are unrelated. This is true regardless of the academic area. As mentioned earlier, previous

research employed citation rates as a measure of journal quality. Cole and Cole (1967) found that citation rate correlated .72 with the number of publications. No data are available on the relationship between citation rate and the quality measure used in the present study. It is possible, therefore, that the difference between the present result and previous findings is due to dissimilar methods of measuring publication quality.

An intriguing alternative to this explanation is that the quantity and quality of publications are not as strongly related as they were when earlier studies were done.[2] This could happen if increasing numbers of scholars were motivated to publish but their publications were not of high quality. Many newly trained scholars may be motivated to publish more to further their own careers, than to make a contribution to the field. Although this argument would be difficult to support empirically, it is consistent with a number of existing critiques of contemporary scholarship. For example, Gouldner (1970) notes the development of a careerist orientation among sociologists in which prestige in society and financial success are increasingly important due to the enlarged role of sociologists in society. Similarly, Chomsky's (1969) critique suggests that scholars in social sciences and history are increasingly motivated to obtain prestige and power in the larger social system.

When all academic areas are considered together, the quality of graduate students' first jobs is unrelated to any other output measure. However, in hard-applied and soft-applied areas, a number of distinct relationships occurred. In hard-applied areas such as engineering and

agriculture, first job quality is significantly negatively related to the number of journal articles published (-.57) and the number of dissertations sponsored (-.49). It was negatively, though not significantly related to all but one of the remaining variables. In soft-applied areas such as education and accountancy, first job quality is positively related to all outputs and significantly related to number of technical reports published (.58) and the quality of journals (.54). The negative relationships in hard-applied areas suggest that the scholar who is publishing journal articles and sponsoring dissertations cannot necessarily obtain the best jobs for his graduate students. It is likely that for many of the jobs in these areas, graduate students are not hired on the basis of their own or their sponsor's research prominence, but rather on the basis of practical skills which were not indexed in the present study. In soft-applied areas, however, it appears that at least one form of research prominence--the quality of the sponsor's journal articles--is an important factor related to the graduate student's first job. The fact that in soft-applied areas the remaining publication outputs are positively associated with first job quality supports this interpretation.

Relationships Among Outputs at the Department Level

Table 6 presents correlations among scholarly outputs at the department level. These relationships are important for determining the value of these variables as indices of departmental performance. Publication data were divided by the number of faculty in the department in 1967. In addition to the outputs examined at the individual level, this

table included American Council on Education ratings of the quality of the department's faculty (Cartter, 1966). Since a department's reputation may, in part, be due to size, the correlations between total number of faculty in the department and journal quality, first job quality, and ACE ratings were also computed.

Insert Table 6 about here

Similar to the findings for the individual level, there is only slight convergence among measures of research outputs when they are used as department criteria. The number of dissertations sponsored per faculty member is significantly positively related to monographs per faculty member (.47). The number of technical reports per faculty member is significantly positively related to journal articles per faculty member (.38). Also, like the individual level results, journal article quantity and quality are unrelated (.04). Journal quality is significantly negatively related to the number of technical reports per faculty member.

The rated quality of graduate students' first jobs is negatively related to the number of monographs per faculty ($r = -.48$, $p < .05$) and positively related to the number of journal articles per faculty member ($r = .39$, $p < .05$). Thus, departments which emphasize journal article publication and deemphasize monograph publication send graduate students on to the best jobs. And the first job measure shows adequate convergence with the ACE ratings of faculty quality ($r = .44$, $p < .05$). Although there was a slight positive relationship between first job quality and dissertations per faculty member, the correlation was not significantly

TABLE 6

Correlations Among Output Variables at

the Department Level

(Publications are per faculty member)

	Monographs	Journal Articles	Journal Quality	Technical Reports	Dissertations	First Job Quality	ACE Ratings
Articles	-.08						
Quality of Journal Articles	-.03 (42)	.04 (42)					
Technical Reports	.01	.38*	-.47* (42)				
Dissertations	.47*	.28	.13 (42)	-.02			
First Job Quality	-.48 * (35)	.39 * (35)	.30 (34)	.09 (35)	.28 (35)		
ACE Rating	-.13 (19)	.52* (19)	.51* (18)	.01 (19)	.67* (19)	.44* (24)	
Total Number of Faculty			.10 (42)			-.17 (43)	.54* (24)

N=44 except where otherwise indicated in parentheses.

*$p < .05$

different from zero (.28). Thus, as is the case for journal articles, quantity and quality appear to be unrelated for graduate training.

The results of this study constitute strong evidence for the validity of the ACE ranking as an index of departmental quality. It is significantly positively related to all but two of the other output measures. Departments which are highly rated by the ACE are also higher in number of journal articles per faculty member (.52), number of dissertations per faculty member (r = .67), journal article quality (r = .51), and the quality of graduate students' first jobs (r = .44). The relationships with journal article quantity and quality suggest that the ACE ratings are meaningfully assessing research productivity and not just reputation. The evidence is all the more convincing since, according to these data, journal article quality and quantity comprise separate components of research output. Similarly, the ACE ratings appear to be tapping both components of graduate training, namely the quantity of graduate students who complete graduate work and their quality as indexed by the jobs they are able to obtain. There is, however, an additional relationship which should temper a positive judgment concerning the ACE ratings. ACE ratings correlate .54 (N = 24, $p < .05$) with the total number of faculty members in the department. This suggests that the department's "visibility" may be an important factor determining a department's high ratings on the ACE measure.

Conclusion

There are a number of implications of these findings which deserve special emphasis.

1. No single criterion of individual scholarly performance seems possible. Regardless of academic area, such measures of research output as the quantity of journal articles and monographs and the quality of journal articles fail to converge with such measures of graduate training effectiveness as dissertations per faculty member and first job quality. Moreover, measures of research output show only moderate convergence with each other and the measures of graduate training effectiveness do not converge at all. No measures of the effectiveness of undergraduate teaching were available in the present study, but we may surmise on the basis of these data that undergraduate teaching performance is not related to other outputs.

2. The ACE ratings of faculty quality appear to provide a good measure of department performance. They are related to both the measures of research output and the measures of graduate training effectiveness. The only possible drawback to this ACE evaluation is its relationship to department size, and this measure may, therefore, be partly a result of departmental visibility.

3. Academic area should be considered in developing performance criteria. This study shows that the rate of scholars' journal article and monograph publications as well as the quality of their journal articles depends on whether the area is "hard" or "soft." Moreover, the rate of scholars' technical report publication is greater for applied than for pure areas. These results suggest that the weight we attach to each output in evaluating the scholar should depend on the academic area. In addition, the relationships among outputs are not always the same in different areas. In hard-applied areas such as agriculture and

engineering, the graduate students who obtain the best jobs are not associated with the more productive researchers or with the scholars who sponsor large numbers of doctoral dissertations. On the other hand, in soft-applied areas such as education, the best jobs appear to go to the graduate students who are associated with the more productive researchers. These findings imply that for some areas, attempts to enhance one kind of output may detract from other kinds of output.

The study presents the First Job Index and the Quality of Journals Index as potentially useful measures for assessing two different aspects of department performance. While the measures are not sufficiently reliable at this time to be useful criteria of individual faculty member performance, they appear satisfactory for evaluating the department's performance.

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Footnotes

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